

SECTION 730 - TRAFFIC SIGNAL INSTALLATION

##This section cross-references Section 733, which should be included in the specification. If Section 733 is not included in the specification, all references to it should be struck out, ensuring that the remaining text is still coherent:

730.01 GENERAL

(a) Scope

This Section covers the requirements for the installation and remodel of traffic signals within the State of Victoria for works supervised by VicRoads.

For the purpose of this specification, traffic signals shall include:

- (i) intersection traffic signals
- (ii) pedestrian operated traffic signals
- (iii) pedestrian (zebra) crossings
- (iv) emergency vehicle access signals
- (v) ramp metering signals.

(b) General Requirements

The Contractor shall be responsible for the supply, installation and commissioning of the traffic signal project as shown on the drawings, or as specified.

(c) Pre-qualified Contractors

All works associated with the installation and commissioning or remodel of traffic signals shall be undertaken only by contractors that are pre-qualified at the STS level under the VicRoads contractor pre-qualification scheme.

Sub-contractors undertaking the installation of vehicle detector loops shall be pre-qualified at the SVDL level.

730.02 DEFINITIONS

Specialist terms used within this section are defined in AS 1348-2002, Road and Traffic Engineering – Glossary of Terms.

The following term is also used in this section:

Remodel - The full or partial rebuilding of an existing traffic signal site for the purpose of upgrading site equipment and/or adding to, deleting from or modifying the existing traffic signals.

730.03 ABBREVIATIONS

The following abbreviations are used in this section:
































ACMA	.....Australian Communications and Media Authority
AS	.....Australian Standard
DC	.....Direct Current
DUSC	.....a modem device used for connecting rural controllers to the SCATS system via a dial-up connection
2A	.....Traffic signal pedestal 3.2m in length
2B	.....Traffic signal pedestal 4.1m in length
Type 3	.....Push button post 1.4m in length
HP	.....Hold Point
JUMA	.....Joint Use Mast Arm
JUP	.....Joint Use Pole
MA	.....Mast Arm
LED	.....Light Emitting Diode
QH	.....Quartz Halogen
TPS	.....Thermoplastic Sheathed

730.04 SITE PLAN

The scope of works, equipment requirements and placement of equipment shall be as shown on the VicRoads Site Plan.

Abbreviation and symbols used on VicRoads Traffic Signal Plans are detailed in Table 730.041 below.

Table 730.041 Abbreviations and Symbols for Traffic Signal Plans

	Existing Pedestal		Active Vehicle Group
	New Pedestal		Permitted Vehicle Group
	New Joint Use Pole		Permitted Pedestrian Movement
	Tramway Pole		Street Lighting Lantern (250W)
	Electricity Distribution Pole		Street Lighting Lantern (150W)
2A	2A Pedestal		Existing Street Lighting Lantern
2B	2B Pedestal		Raised Pavement Marker
T3	Type 3 Pedestal		Raised Reflective Pavement Marker
MA	Mast Arm		Side Entry Pit
JUP	Joint Use Pole		Grated Pit
JUMA	Joint Use Mast Arm		Sewerage Pit
	3 Aspect Vehicle Lantern	xFH	Fire Hydrant or Plug
	3 Aspect Vehicle Lantern on MA	xSV	Stop Valve
	Pedestrian Lantern	Z	Gas Supply Valve
	Pedestrian Push Button		Electricity Supply Pit
	Internally Illuminated Sign		Telecommunications Pit or Box
	Static Sign	○ TP	Telecommunications Pillar
DS	Direction Sign		Unclassified Utility
NSAT	No Standing Any Time	(E)	Existing Feature
NS	No Standing		Overhead Electricity Cable
NRT	No Right Turn	— S —	Underground Sewer Main
NLT	No Left Turn	— E —	Underground Electricity
GWTP	Give Way To Pedestrians	— G —	Underground Gas
	Detector Loop	— W —	Underground Water
	Existing Detector Loop	— T —	Telecommunications Cable
<u>1/100</u>	Underground Conduit - No./Size	— / —	Fence
	600mm Cable Pit		
	300mm Detector Pit		
	Traffic Signal Controller		

730.05 REFERENCED AND RELATED SPECIFICATIONS, STANDARDS AND DRAWINGS

The fabrication and supply of all components for traffic signal works shall conform to all relevant VicRoads Specifications and Australian Standards.

All traffic signal equipment shall conform to the general requirements of:

- (a) VicRoads 'TCS' series specifications
- (b) VicRoads 'TC' series specifications
- (c) AS 1742 Manual of Uniform Traffic Control Devices
- (d) AS/NZS 3000 Wiring Rules
- (e) Victorian Service and Installation Rules.

The individual requirements of the Victorian Electricity Supply Industry (VESI) and the local electricity distribution business shall apply for matters relating to the provision of mains power.

The relevant requirements of the Australian Communications and Media Authority (ACMA) shall apply to the provision of all communications facilities.

All traffic signal works shall be conducted in accordance with the appropriate VicRoads Traffic Control (TC) Series Standard Drawings.

VicRoads Standard Drawings referred to in this section are listed in Table 730.051 below.

Table 730.051 List of Standard Drawings

Drawing Number	Title
TC-1000	Typical Layouts
TC-1001	Typical Pavement Marking - Traffic Signals
TC-1003	Typical Layouts for Pedestrian Operated Signals
TC-1005	Typical Layout for PUFFIN Pedestrian Operated Signals
TC-1104	Typical Layout - Flashing Pedestrian Crossing
TC-1112	Typical 5.5m Mast Arm Installation (2.5m Outreach)
TC-1115	Lantern and Mounting Bracket Orientation
TC-1116	Traffic Signal Mounting Arrangements
TC-1119	Lantern Mounting Details
TC-1125	Post Installation Details for Signs
TC-1126	Pedestal Location Under or Through Verandahs
TC-1127	Traffic Signal - Visor Types and Dimensions
TC-1131	Not In Use Sign
TC-1200	Foundation for Pedestals
TC-1201	Bored Pile Foundation for MA, JUP and JUMA
TC-1202	Spread Footing Foundation for MA, JUP and JUMA
TC-1203	Traffic Signal Controller Foundation Details

.... table continued next page

Table 730.051 List of Standard Drawingscontinued

Drawing Number	Title
TC-1204	51 Core for Intersections Cable (connections)
TC-1205	Multicore Cable Connections for Pedestrian Operated Signals
TC-1206	Assembly and Installation of Consumer Mains and Meter Box
TC-1207	General Layout – Traffic Signal Ducting
TC-1208	Underground Conduit Warning Sign
TC-1210	Cable Pit Former – 600 mm Diameter
TC-1211	Heavy Duty Cable Pit
TC-1214	Suitable Arrangement Dual 51 Core Terminations for Complex Intersection
TC-1215	Suitable Arrangement Dual 51 Core Terminations for Diamond Interchange
TC-1216	Cable Connections for Flashing Pedestrian (Zebra) Crossings
TC-1220	Cable Pit Access cover and Frame 600 mm Diameter
TC-1230	Cable Pit - Installation Details
TC-1300	Loop Pattern and Installation Details - Symmetripole
TC-1301	Vehicle and Tram Detector Loops Along Shared and Exclusive Tram Lines
TC-1310	Detector Pit and Lid
TC-1320	Detector Pit Installation Details
TC-1332	Advance Tram Detection (Feeder Cable Details)
TC-1380	Concrete Slab For Tram Detectors
TC-1601	Rag Bolt Assembly - M24 CG and HS 600 mm x 350 mm PCD
TC-1603	Rag Bolt Assembly for Cabinet M12 600 x 460 x 255
TC-2100	Standard Cabinet Label
TC-2101	Small Cabinet Label
TC-2104	Pedestrian Label

NOTE: VicRoads Standard Drawings, Specifications and Guidelines are available for downloading from the VicRoads website at: [Technical publications : VicRoads](#)

730.06 EQUIPMENT TO BE SUPPLIED BY VICROADS

VicRoads will supply or arrange for the supply of the following items:

- (a) the traffic signal controller and associated vehicle detector units
- (b) tram detectors
- (c) communication devices, such as Dial-IP modems
- (d) 'DUSC' units.

VicRoads reserves the right to add to, delete from, or modify, the list of items to be supplied by VicRoads for any specific project.

Strike out the paragraphs below if VicRoads is not supplying JUPs or JUMAs:

Unless otherwise specified, VicRoads will arrange for an approved provider to deliver any MA, JUMA or JUP to the worksite and to lift such items into place to be assembled, erected and fitted off by the Contractor.

The Contractor shall provide to the Superintendent a list of such poles to be supplied, at least twenty working days before delivery is required.

The Contractor shall be responsible for the care, transport and handling of all VicRoads supplied materials issued to the Contractor.

730.07 EQUIPMENT TO BE SUPPLIED BY THE CONTRACTOR

Other than those items listed in Clause 730.06, the Contractor shall be responsible for the supply of all equipment, items and peripherals required for the completion of the works.

Where applicable, all equipment proposed for use shall hold current VicRoads 'Type Approval' certification or Product Acceptance.

All equipment, materials and fittings supplied by the Contractor are to be new.

The Contractor is to ensure that all equipment used is compatible with all other equipment in the installation.

730.08 PROJECT COMMENCEMENT

(a) Pre-Construction

The Contractor shall be responsible for locating and proving all underground and overhead services which may be affected by the works and for coordinating the activities of the service authorities in the locating of services and carrying out of any alterations to services.

Any consultation with, and authorisation required from, other authorities under relevant utility regulations and codes shall be the responsibility of the Contractor.

(b) Pre-Installation Meeting

The Superintendent/~~Contractor~~ superintendent or contractor as required: shall arrange a pre-installation meeting, to be convened by the Superintendent, consisting of representatives of the, Contractor, VicRoads, service authorities, municipalities, and others as appropriate.

The Contractor shall ensure that the agenda for the meeting includes those matters that need to be resolved for the project to proceed expeditiously.

At the meeting, the Contractor shall mark the position of pedestals, poles, controller bases, pits and conduits in accordance with the drawings, in the presence of and with the approval of the Superintendent.

Where trees, poles, obstructions, services, or other site conditions prevent or adversely affect sight lines or obstruct the location as specified, the Contractor shall determine an alternate location for the affected aspect of the works and obtain approval of the Superintendent of the nominated change.

The marked location of each item approved by the Superintendent prior to excavation of foundations shall constitute agreement of the location only and shall in no way relieve the Contractor from his responsibilities under the Contract.

On satisfactory completion of the pre-installation meeting, the Superintendent will issue to the Contractor a copy of the Pre-Installation Report.

HP The Contractor shall not commence installation of the traffic signal pedestals, poles, controller bases or pits until the Pre-Installation Report has been approved.

730.09 CONDUITS

The Contractor shall install all conduits in accordance with Section 733.

All electrical conduit installation works for traffic signals must be carried out by, or under the direct supervision of, a VicRoads pre-qualified traffic signal Contractor and in accordance with the requirements of Energy Safe Victoria.

All communication conduit installation works are to be carried out under the 'on site' supervision of a licensed cabler.

A plan showing the as-constructed conduit locations and depths shall be provided to the Superintendent and a copy left in the controller cabinet.

730.10 PITS

The Contractor shall install all pits in accordance with Section 733.

All cable pit installation works for traffic signals must be carried out by, or under the direct supervision of a VicRoads pre-qualified traffic signal Contractor and in accordance with the requirements of Energy Safe Victoria.

All communication pit installation works are to be carried out under the 'on site' supervision of a licensed cabler.

730.11 FOUNDATIONS

Foundations shall be located in accordance with the drawings and as approved at the Pre-Installation Meeting.

When locating foundations, the Contractor shall ensure that all the required clearances of the installed hardware are achieved.

No part of the signal hardware is to be closer than 500 mm behind the face of the nearest kerb line, or closest vehicle path if no kerb is present.

In accordance with VicRoads Standard Drawing TC-1112, the minimum clearance of 5.5 m shall be achieved between the lowest part of a lantern installed on an outreach and the roadway directly beneath it.

Foundations and footings shall be as specified in the VicRoads Standard Drawings for the specific item of equipment they are to support, as listed in Table 730.111 below.

Table 730.111 Standard Foundation Types

Foundation Type	Used For	Standard Drawing
Pedestal	2A, 2B, Type 3	TC-1200
Bored Pile	MA, JUMA, JUP	TC-1201
Spread Footing	MA, JUMA, JUP	TC-1202
Rag Bolt Assembly	All poles	TC-1601
Controller	Traffic signal controller	TC-1203
Street lighting	Distribution box	TC-1062
Rag bolt assembly	Traffic signal controller	TC-1603

The standard foundation for an MA, JUMA and JUP shall be a bored pile.

Where the installation of a bored pile foundation is not feasible and the Contractor proposes to install a spread footing, or adopt an alternative design, the Contractor shall obtain the prior approval of the Superintendent.

Where the Contractor proposes an alternative footing design to those shown on the VicRoads Standard Drawings, the Contractor shall provide sufficient evidence and proof engineering to the Superintendent to confirm that the proposed footing arrangement is fit for purpose.

Wherever possible, when foundations for pedestals and poles are cast into concrete structures, two rag bolt assemblies shall be installed similar to the arrangement shown in VicRoads Standard Drawing TC-1202.

HP All conduit, pit and foundation works shall be inspected by the Superintendent prior to the Contractor covering the works.

730.12 SUPPLY AND PLACEMENT OF CONCRETE IN FOUNDATIONS

(a) General

The Contractor shall be responsible for the procurement of all concrete in accordance with the requirements of AS 1379.

(b) Placement of Concrete

Where concrete is placed in a bore hole, it shall be compacted with immersion type, high frequency vibrators.

Concrete shall be placed through a tremie tube and shall not be dropped from a height greater than 2 m. Concrete which is being discharged from a tremie shall be guided away from the reinforcement so that segregation is not caused by the flow of concrete impinging on the reinforcement.

Alternative methods for placing concrete in the bored hole from those specified in this clause may be used subject to a review by the Superintendent.

(c) Project Testing

All grade 32 MPa concrete shall be sampled and tested in accordance with AS 1012 and AS 1379. Each sample of concrete shall be tested for compressive strength and slump. The Contractor shall develop and implement a site sampling procedure for concrete quality assurance. All concrete samples shall be taken at the point of discharge prior to placement.

Each sample of concrete for standard compression tests shall comprise a minimum number of 3 cylinders. A minimum of 1 cylinder per sample shall be tested at 7 days and a minimum of 2 cylinders per sample shall be tested at 28 days.

(d) Testing and Acceptance of Concrete on the Basis of 28 Day Compressive Strength

A minimum of 2 cylinders per sample shall be tested at 28 days after casting. The specification requirements will be met if the compressive strength of each sample, as determined from the average value of the test cylinders, is not less than the specified minimum 28 day compressive strength and provided that the compressive strength of any cylinder in each sample is not less than 90% of the specified minimum 28 day compressive strength.

Should the strength of any sample fail to meet the specified minimum 28 day compressive strength, the concrete represented by that sample will be rejected. The Contractor shall then develop a procedure to achieve the specification requirements and provide for the Superintendent's review and approval.

730.13 TRAFFIC SIGNAL HARDWARE

(a) Standing of Pedestals and Poles

Pedestals and poles shall be installed in accordance with the following requirements:

- (i) pedestals and poles shall be fastened to the rag bolt assembly cast into the foundations, as detailed on VicRoads Standard Drawing TC-1201, with the nuts tightened to 150 Nm of torque
- (ii) pedestals and poles shall be installed such that they are vertical when fully loaded
- (iii) pedestals shall not be stood within 48 hours of casting of the foundations
- (iv) JUP, MA and JUMA poles shall not be stood within 7 days of the casting of the foundations
- (v) poles shall be installed such that the access door is on the face furthest from the traffic flow.

(b) Lanterns

Lanterns shall be installed in accordance with the following requirements:

- (i) all traffic signal lanterns installed on any new or major remodel installation (where all lanterns are being replaced) shall be LED type
- (ii) for minor remodels QH lanterns are permitted; however, the mixing of LED with incandescent or QH lanterns is not permitted.

(c) Installation of Hardware

Hardware shall be installed in accordance with the following requirements:

- (i) all lanterns shall be mounted vertically, using standard straps securely fixed to mounting brackets or lugs
- (ii) upper mounting brackets shall be oriented and fixed to the top of pedestals in accordance with Standard Drawing TC-1115
- (iii) two-way and four-way lower mounting brackets shall be fixed as required to provide suitable mounting points for the installation of lanterns
- (iv) the top and bottom of each lantern must be firmly attached to ensure that it will not rotate
- (v) each lantern shall be attached so as to provide an unobstructed line of sight to the traffic which it controls, and such that the potential to be hit by vehicles is minimised
- (vi) external cables and conduits shall be fixed to pedestals, poles or supports using suitable plastic cable ties
- (vii) cable connections to lanterns shall be of sufficient length to hang below the cable entry point on the lantern, but not hang below the lower mounting strap, as shown on VicRoads Standard Drawing TC-1119, and shall be securely fixed by means of cable ties
- (viii) cable connections to lanterns shall be made with continuous lengths of cable; no joins shall be allowed; this will typically require the cables supplied with lanterns to be replaced with longer cables when installed on mast arm outreaches
- (ix) junction boxes, key switches, and all other electrical hardware shall comply with the relevant Australian Standards.

(d) Lantern Mounting Heights

Lantern mounting heights shall be in accordance with the following requirements:

- (i) mounting heights for lanterns on 2A and 2B pedestals shall be as specified on VicRoads Standard Drawing TC-1116
- (ii) lanterns installed on the vertical section of an MA, JUP and JUMA shall be mounted on lugs so as to give the same mounting heights for the respective lantern positions as specified on VicRoads Standard Drawing TC-1116

- (iii) lanterns on the outreach of an MA or JUMA shall be mounted in accordance with VicRoads Standard Drawing TC-1112
- (iv) 1 and 2 aspect lanterns shall be installed to achieve the mounting height of an aspect of the same colour as if it were part of a 3 aspect lantern
- (v) 2 aspect bicycle lanterns shall be mounted at the same height as pedestrian lanterns
- (vi) aspects fitted with white or lunar white lenses shall be mounted at the same height as a green aspect
- (vii) lanterns mounted on poles not belonging to VicRoads shall be mounted at the same heights as specified on VicRoads Standard Drawing TC-1116
- (viii) internally illuminated signs shall be mounted at a height to provide a clearance of not less than 2.4 m from the finished surface level
- (ix) flashing yellow signals used at pedestrian crossings shall be mounted at the height specified on VicRoads Standard Drawing TC-1104.

(e) Lantern Alignment

The alignment of lanterns shall be in accordance with the following requirements:

- (i) vehicle lanterns shall be aligned so as to provide optimum visibility for approaching traffic considering road alignment, speed, visibility and other site characteristics
- (ii) generally, lanterns shall be aimed at a point on the centre of the approach, at a distance before the stop line as shown in Table 730.131 below

Table 730.131 Lantern Alignment Distances

Lantern	Distance
Primary	240
Secondary	150
Tertiary	5

- (iii) pedestrian lanterns shall be aimed at the mid-point of the cross walk on the opposite side of the carriageway to which it applies.

(f) Target Boards, Visors and Louvres

All target boards shall be metal type.

Target boards shall be fitted to all lanterns in accordance with VicRoads Standard Drawing TC-1119.

Visors for LED Lanterns shall be fitted as specified in Table 730.132 below.

Table 730.132 Visors for LED Lanterns

Lantern Location	Visor Type	Cutaway
MA or JUMA Outreach	1	Both Sides
L/H Primary	1	Both Sides
R/H Primary	1	Both Sides
Secondary and Tertiary	3 – Short	None
Pedestrian and Bicycle	4	None

Note: Refer to VicRoads Standard Drawing TC-1127 for details of the visor types.

Louvres shall not be installed on LED lanterns unless otherwise specified.

Where QH lanterns have been specified, visors shall be fitted as specified in Table 730.133 below.

Table 730.133 Visors for QH Lanterns

Lantern Location	Visor Type	Cutaway
MA or JUMA Outreach	1	Both Sides
L/H Primary	2	R/H
R/H Primary	2	L/H
Secondary and Tertiary	3 – Long	None
Pedestrian and Bicycle	4	None

Note: Refer to VicRoads Standard Drawing TC-1127 for details of the visor types.

All visors fitted to QH lanterns shall be fitted with horizontal half louvres, except in the following situations:

- (i) lanterns on the outreach of an MA or JUMA
- (ii) overhead lane control signals
- (iii) symbolic displays.

All louvres fitted to visors shall be attached using pop rivets or another method approved by the Superintendent.

Vertical louvres shall be installed where shown on the drawings, or otherwise specified.

(g) Installation of Pedestrian Push Buttons

Pedestrian push buttons shall be installed in accordance with following requirements:

- (i) pedestrian push button assemblies shall be mounted clear of any access openings and such that the centre of the button is 1.0 m above finished surface level, as shown on VicRoads Standard Drawing TC-1116
- (ii) the face of the button shall be at right angles to the direction of the associated walk lines
- (iii) the tactile arrow indicator shall be oriented to indicate the walk direction to which the button relates, with the arrow pointing up to indicate a straight ahead walk direction
- (iv) where a single button is mounted in a median, a double headed arrow plate shall be used with the arrow oriented horizontally and the front face of the button shall be parallel with the walk direction
- (v) a seam of silicone sealant shall be applied between the back of the button housing and the pole to prevent the ingress of water into the pole; the sealant shall be applied across the top and on both sides of the button
- (vi) a label complying with VicRoads Standard Drawing TC-2104 shall be installed on the pedestal or pole directly above each pedestrian push button.

(h) Audio Tactile Devices

Where specified on the drawings, audio tactile units of the type nominated shall be mounted as shown on VicRoads Standard Drawing TC-1116.

(i) Puffin Pedestrian Operated Signals

Where a 'Puffin' (Pedestrian User Friendly and Intelligent) Crossing is specified, the Contractor shall install approved Puffin Crossing 'Walk' detectors in accordance with VicRoads Specification Puffin Crossing 'Walk' Detectors, TCS 027, and VicRoads Standard Drawing TC-1005.

(j) Flashing Pedestrian Crossings

Flashing pedestrian crossings shall be installed in accordance with VicRoads Standard Drawing TC-1104.

(k) Attachment of Equipment to Other Supports

Attachment of traffic signal equipment to service poles or structures which are not owned by VicRoads shall be by means of matt stainless steel straps, coach bolts or masonry bolts as applicable, or such other methods as approved by the relevant authority, the owner of the pole or structure and the Superintendent.

Above ground conduits attached to structures or poles owned by other agencies shall be 25 mm diameter galvanised wrought iron conduit or steel sheathing of an approved type.

Above ground conduits shall extend up to a termination point for the electrical cables or to a height of 3 metres whichever is the lower.

All traffic signal equipment and cabling mounted on tramway poles shall be externally attached to the pole and must be electrically insulated from the pole in order to minimise the risk of a DC injection resulting from a fault with the overhead tramway cable.

(l) Non-Commissioned Lanterns

The faces of all installed but not yet operating lanterns shall be covered.

At sites that have not been switched on, all vehicle lanterns shall be covered with 'NOT IN USE' signs as specified on VicRoads Standard Drawing TC-1131.

At remodel sites, or sites where existing lanterns are operating, all non-operating lanterns shall be covered with a blanking sign as specified on VicRoads Standard Drawing TC-1131, or may be turned so as not to be visible to traffic.

(m) Awnings

Where pedestals need to be installed under or through awnings or verandahs, the installation shall be in accordance with VicRoads Standard Drawing TC-1126.

The Contractor shall be wholly responsible for providing and making good any holes through awnings which may be necessary for the erection of pedestals.

Where pedestals pass through awnings, a clearance all round shall be left between the pedestal and the awning and finished such that water from the awning cannot flow into the opening.

Any alterations to the awning shall be carried out by a qualified plumber and with the agreement of the owner of the awning.

HP All installed hardware shall be inspected by the Superintendent prior to works proceeding.

730.14 ELECTRICAL SYSTEM

All electrical works, conduits, fittings, materials and installations shall comply with the requirements of AS/NZS 3000 Wiring Rules for all traffic signal related works.

(a) Point of Supply

Point of supply for traffic signal installation shall be in accordance with the following requirements:

- (i) the 'Application for Supply of Power' shall be completed and submitted by VicRoads
- (ii) the Contractor shall arrange for the installation of the point of supply with the local power distribution company, at the location approved at the pre-installation meeting
- (iii) where permitted by the distribution company, the point of supply shall be installed in accordance with VicRoads Standard Drawing TC-1206

- (iv) if installation in accordance with TC-1206 is not permitted, the main switchboard shall be installed in a distribution company approved supply enclosure
- (v) the supply enclosure should be located between 3 m and 6 m from the controller cabinet to minimise the risk of both the controller and the point of supply being hit by an errant vehicle in the same incident
- (vi) the main switchboard shall contain a main switch and/or suitably sized circuit breaker
- (vii) access to the main switchboard shall be via a standard VicRoads traffic signal controller Bi-Lock key
- (viii) where possible, the earth stake shall be installed in the base of the supply enclosure; otherwise it shall be installed in an adjacent pit
- (ix) the main switchboard shall contain the MEN (Multiple Earthed Neutral) link
- (x) if a meter is required by the distribution company, it shall be installed in a distribution company approved supply enclosure
- (xi) if a street lighting distribution cabinet is to be installed as part of the project, the point of supply for the traffic signals shall be provided by means of a separately metered circuit within the cabinet
- (xii) the circuit breaker controlling the traffic signals shall be clearly marked.

The Contractor shall lodge all relevant associated documentation to comply with the requirements of the Office of the Chief Electrical Inspector and the local Distribution Business for the provision of a 240 v 50 Hz single phase power supply for final termination on not less than a 32 amp service fuse.

Any arrangements for the supply of power that are not consistent with current VicRoads practice shall be submitted to the Superintendent for approval.

NOTE: At the time of publication, an alternative point of supply installation method is being investigated. When this alternative method has been approved, an amendment will be issued.

(b) Provision of Communication Line

The Contractor shall supply and install a 20 mm white 'Telstra' communication conduit together with a two pair telecommunication cable from the controller to the nearest suitable communication supplier's pit as shown on VicRoads Standard Drawing TC-1207.

The Superintendent shall make application for the line and advise the Contractor on availability of same.

Connection of the communication line shall be the responsibility of others.

(c) Site Cabling

Cabling shall be installed in accordance with the following requirements:

- (i) only VicRoads Type Approved cable shall be used
- (ii) inter-connecting traffic signal cables shall be drawn through the conduits and pits as shown on the drawings
- (iii) a draw cord shall be left in each conduit at the completion of the cabling
- (iv) a spare length of not less than 1.5 m of each inter-connecting cable shall be coiled in each cable pit
- (v) all cables shall be installed in a manner which ensures that sheathing and insulation are not damaged
- (vi) any cables damaged during installation or remodel works shall be immediately replaced by the Contractor at no additional cost to VicRoads

- (vii) site cables shall be appropriately restrained at the point of termination (e.g. top of pedestals, access points in MAs, JUPs, etc.) to ensure that stress on terminations (due to the self weight of the cable) is minimised
- (viii) cables at the traffic signal controller base shall be coiled in the pit and appropriately secured
- (ix) sufficient cable shall be provided to reach 1.5 m above the controller base
- (x) no jointing of any multi-core, linking or communications cable shall be permitted.

(d) Cable Sizes and Wiring Arrangements

With the exception of terminations at the controller, all cables and wiring shall be installed by the Contractor and shall comply with the following requirements:

- (i) at **intersection traffic signals**, the traffic signal controller and all upper mounting assemblies and/or terminal assemblies (in MAs, JUMAs and JUPs) shall be connected by a **51 core cable** in a continuous ring circuit arrangement in accordance with VicRoads Standard Drawing TC-1204
- (ii) at **pedestrian operated signals (dual carriageway)**, the traffic signal controller and all upper mounting assemblies and/or terminal assemblies (in MAs, JUMAs and JUPs) shall be connected in sequence by a **29 core cable** circuit in accordance with VicRoads Standard Drawing TC-1205
- (iii) at **pedestrian operated signals (single carriageway)**, the traffic signal controller and all upper mounting assemblies and/or terminal assemblies (in MAs, JUMAs and JUPs) shall be connected in sequence by a **19 core cable** circuit in accordance with VicRoads Standard Drawing TC-1205
- (iv) at **flashing pedestrian crossing (Zebra) signals**, the control equipment and all upper mounting assemblies and/or terminal assemblies shall be connected by a **13 or 19 core cable** in accordance with VicRoads Standard Drawing TC-1216
- (v) for **spurs and flashing (red or yellow) signals**, the control equipment and all upper mounting assemblies and/or terminal assemblies shall be connected in sequence by a **19 core cable** branch circuit
- (vi) at **ramp metering signals**, the traffic signal controller and all upper mounting assemblies and/or terminal assemblies (in MAs, JUMAs and JUPs) shall be connected by a **13 core cable**.

(e) Cabling of Pedestrian Push Buttons

Pedestrian push button detectors shall be connected by flexible 5 core cable (each core shall have a cross sectional area of not less than 1.5 mm²) to the appropriate termination positions for the multi-core traffic signal cables.

The termination of push button cable connections shall be as detailed in Table 730.141 below.

Table 730.141 Pedestrian Push Button Cable Connections

Core Colour	Function
White	Push Button
Blue	Push Button return
Brown	Call Record
Black	Call Record return
Green/Yellow	Earth

(f) Connection of Traffic Signal Controller

The Contractor shall install a 3 core low voltage power supply cable (i.e. TPS) in a 50 mm conduit between the point of supply and the controller base in accordance with the requirements of the local power distribution company.

Sufficient cable shall be provided to reach 1.0 m above the controller base.

An additional length of at least 1.5 m of the power supply cable shall be left coiled in the pit closest to the controller base.

The active and neutral cores of the power supply cable shall have a cross sectional area not less than 6 mm².

(g) Detector Feeder Cables

Detector feeder cables shall be used to connect detector loops to the traffic signal controller and shall be installed in accordance with the following requirements:

- (i) detector feeder cable shall be a Type Approved 2 core or 8 core shielded cable, 1 cable per loop and each cable pair shall be clearly and durably marked at both ends to enable positive identification
- (ii) the maximum length of any individual detector feeder cable shall not exceed 200 m
- (iii) the Contractor shall connect the detector loop cables to the detector feeder cables in accordance with this section by soldering
- (iv) the 4 wires for each individual loop (e.g. 9SA, 9FA, 9SB and 9FB as shown in Standard Drawing TC-1300) shall be tied together in a knot located close to the conduit end
- (v) unused loop cable ends shall be left open circuit
- (vi) all terminations, joined or unjoined, shall be separately insulated and sealed against the ingress of moisture with heat shrink containing resin or another acceptable method approved by the Superintendent
- (vii) detector feeder cables shall be left unterminated and coiled in the pit closest to the controller base
- (viii) each detector feeder cable shall have sufficient length to allow 1.5 m to be coiled in the pit and to reach 1.5 m above the top of the controller base
- (ix) each feeder cable shall be clearly marked or labelled to clearly identify the connected loop
- (x) a cable diagram shall be provided to the controller installation contractor detailing the loop cable/feeder cable connections.

(h) Miscellaneous Cabling

For miscellaneous cable usage, refer to Table 730.142 below.

Table 730.142 Miscellaneous Cable Usage

Application	Cable Type
Branch circuits off a ring circuit	19 core traffic signal cable
Linking cable between the controller and public transport or emergency service facilities (left labelled but unterminated at the controller base)	Suitable multi-core data cable or 19 core traffic signal cable

(i) Cabling of Large Sites

For large sites where the standard allocation of cores cannot be readily adopted, a cable chart shall be provided to the controller contractor and a copy left in the controller cabinet.

Suitable arrangements for the cabling of a large site and also for a freeway diamond interchange site are shown on VicRoads Standard Drawings TC-1214 and TC-1215 respectively.

HP For large signal installations where the standard allocation of cores as specified in VicRoads Standard Drawing TC-1204 cannot readily be adopted, the Contractor shall draw up a proposed cabling scheme and submit this to the Superintendent for approval.

(j) Installation of Detector Loops

The Contractor shall arrange for the installation of vehicle detector loops in accordance with the drawings.

Vehicle detector loop installations shall conform to VicRoads Specification for the Installation of Inductive Detector Loop, TCS 054.

Where there are 2 lanes, each loop may be cut back to the same side of the road, or 1 to each side.

Where there are 3 or more lanes, the loops shall be cut back to the closer side of the road. Table 730.143 shows some examples for typical installations.

Table 730.143 Cutting of Detector Loops

Number of Lanes	Loops Cut to Left Kerb	Loops Cut to Right Kerb
3	2	1
4	2	2
5	3	2
6	3	3

Wherever possible, cutting loops into steel reinforced concrete bridge decks should be avoided.

(k) Electrical Works for Street Lighting

Where VicRoads owned and operated street lighting is to be installed, it shall be carried out in accordance with VicRoads requirements.

Where the isolation switch for a traffic signal installation is located within a street lighting distribution cabinet, the Contractor shall ensure that a key to the street lighting cabinet is installed in the traffic signal controller cabinet.

Any distribution company (VESI) street lighting to be installed shall be installed in accordance with the local distribution company standards and requirements.

(l) Testing of Electrical Works

The electrical installation shall be tested for correct cabling by the Contractor.

The Contractor shall be responsible for all testing associated with the proving of the electrical circuits in accordance with the requirements of AS/NZS 3000 Wiring Rules and AS/NZS 3017.

In particular, the following tests shall be carried out prior to installation of lanterns and hardware:

- (i) continuity of all active conductors
- (ii) continuity of neutral and ELV conductors
- (iii) continuity of earthing system in accordance with Clause 8.3.3 of AS/NZS 3000
- (iv) insulation resistance test of all field cables in accordance with Clause 8.3.3 of AS/NZS 3000 wiring rules.

HP The results of the above tests shall be recorded on the forms provided at the end of this section and a copy provided to the Superintendent.

Following the installation of all lanterns and hardware, the Contractor shall carry out a flash test.

730.15 PUBLIC TRANSPORT AND EMERGENCY VEHICLE INTEGRATION

(a) Signals at Railway Level Crossings

The Contractor shall obtain all the necessary permits and approvals for working on and adjacent to the rail track owner's, or the railway operator's, property and equipment.

Where specified on the drawings, the Contractor shall install a 10 pair approved communication cable (colour coded) between the traffic signal controller and the railway control equipment.

Where traffic signals are to be installed on each side of the railway, the Contractor shall supply and install 2x 100 mm diameter conduits with draw cords as shown on the drawings and agreed by the railway track owner.

The Contractor should note, one of these conduits shall be for the traffic signal ring circuit cables, the other for any ancillary site equipment.

(b) Tram Detection

Tram detection may be provided by one of the following:

- (i) overhead line skate;
- (ii) transponder;
- (iii) loop within tracks;
- (iv) manual or automatic points;
- (v) manual input; or
- (vi) other means as detailed in individual tender documents.

Tram detection shall be installed by the Contractor as shown on the drawings.

Where tram track loops are shown on the drawings, the Contractor shall arrange for the installation of the tram track loops in accordance with VicRoads Standard Drawings TC-1301, TC-1332 and TC-1380.

Where advance detection is specified, the Contractor shall install the conduits and pits at each end of the run in accordance with VicRoads Standard Drawing TC-1332, connect the detector feeder cable to the advance detector loop and run the cable to the controller base.

Where an overhead line skate is installed, the Contractor shall install the conduit on the pole to which the skate has been cabled and the adjacent pit as Detail B of Standard Drawing TC-1332, and run the feeder cable to the controller.

Sufficient detector feeder cable to run between the skate or advance detector loop and the controller shall be provided and installed by the tramway operator and left coiled on the appropriate poles.

(c) Co-ordination with Emergency Vehicle Operations

Where specified on the drawings and in a location approved by the Superintendent and the owner of the affected properties, the Contractor shall provide a suitable cable (refer to Table 730.132) within a 50 mm conduit, between the controller and the push button in the emergency premises.

730.16 PRE-COMMISSIONING

(a) Pre-Commissioning Site Inspection

Upon completion of the installation works, a complete pre-commissioning inspection shall be undertaken by the Contractor.

The Contractor shall provide 24 hours notice to the Superintendent of the time of the inspection.

The Contractor shall complete the Pre-Commissioning Installation Report and provide it to the Superintendent.

Any item found to be defective or incorrectly installed shall be replaced and/or rectified prior to commissioning.

The Contractor shall advise the Superintendent if any aspect of the works has not been completed.

(b) Provision of Power

The Contractor shall arrange for the submission of all necessary paperwork, inspections, payment of fees, etc., to obtain connection to mains supply.

The Contractor shall advise the Superintendent when power is available at the site.

(c) Traffic Signal Controller Installation

The Contractor shall advise the Superintendent when the site is complete and tested and ready for the traffic signal controller to be installed.

The traffic signal controller will be installed by the controller supplier or an authorised representative.

The Superintendent shall advise the Contractor when the controller installation contractor's works have been completed.

The Contractor shall arrange for the issuing of the Certificate of Electrical Safety and be responsible for the submission of all necessary paperwork, inspections, payment of fees, etc., to obtain connection of mains supply to the site.

730.17 COMPLETION OF SITE WORKS AND COMMISSIONING

(a) Switch-On

VicRoads shall co-ordinate the site switch-on and arrange for all involved parties to be on site.

It is strongly recommended that the local area maintenance contractor be present at the switch on.

HP

Prior to switching the signals on, the Contractor, together with the controller installer, shall carry out a 'flash' test of the installation to ensure that each lantern is connected to the correct cable core. The flash test shall be witnessed by the Superintendent and confirmed as acceptable.

On agreement from the Superintendent, the traffic signal installation shall be switched on and thoroughly checked and monitored to ensure safe and proper operation.

The Contractor shall lodge copies of all applications and notices relating to the supply of power and wiring of the site, together with the Certificate of Electrical Safety to the Superintendent.

The time and date of the switch-on shall be recorded on the Controller Record Card in the controller.

The controller supplier is responsible for recording the time and date of switch-on and for the power consumption readings as required in the Electrical Test Report.

(b) Removal of Redundant Hardware

All redundant components of the hardware and equipment (except those components below the finished surface level at the pedestals) shall be removed unless otherwise specified or shown on the drawings.

Hardware and equipment attached to the redundant pedestals shall be removed prior to cutting off and removal of the pedestals.

All holes and depressions formed by the cutting off and removal of pedestals and by the removal of any other items shall be made safe and reinstated to the level of the surrounding surface.

Footpaths and paved areas shall be reinstated to the satisfaction of the Superintendent.

The Contractor shall be responsible for disposal of all redundant materials and hardware.

Existing traffic signal equipment and hardware which is not re-used, but is to be salvaged, shall be delivered in good condition to a location specified by the Superintendent.

Any disused cable pits shall be backfilled to the satisfaction of the Superintendent.

Electrical Test Report

Site Name:	
Suburb/City:	Site No:

Continuity Test of All Active Cables

Core	Ohms	Core	Ohms	Core	Ohms
Earth		15		32	
Neutral		16		33	
ELV		17		34	
1		18		35	
2		19		36	
3		20		37	
4		21		38	
5		22		39	
6		23		40	
7		24		41	
8		25		42	
9		26		43	
10		27		44	
11		28		45	
12		29		46	
13		30		47	
14		31		48	

Test carried out by:

Signed:	Date:
Print Name:	
Company:	

Insulation Resistance Test of All Field Cables

Core	Ohms	Core	Ohms	Core	Ohms
Neutral		16		33	
ELV		17		34	
1		18		35	
2		19		36	
3		20		37	
4		21		38	
5		22		39	
6		23		40	
7		24		41	
8		25		42	
9		26		43	
10		27		44	
11		28		45	
12		29		46	
13		30		47	
14		31		48	
15		32			

Test carried out by:

Signed:	Date:
Print Name:	
Company:	

Power Consumption Record

Site Name:	
Suburb/City:	Site No:

Voltage	
Current Reading (minimum)	
Current Reading (maximum)	

Readings carried out by:

Signed:	Date:
Print Name:	
Company:	